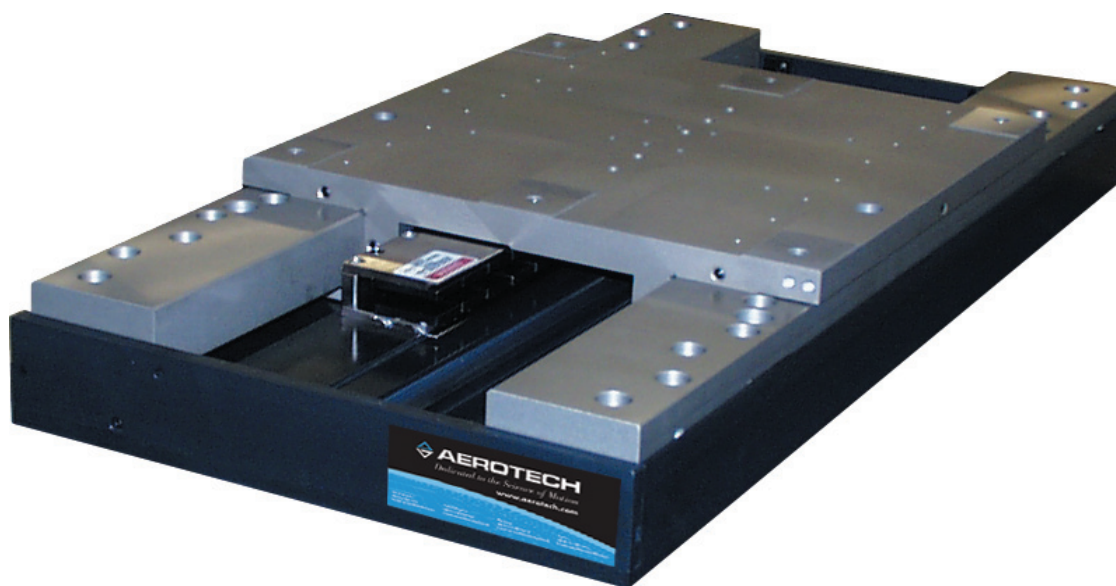


# **ABL8000 Series Stage**

## **User's Manual**

P/N: EDS178 (Revision 1.00.00)



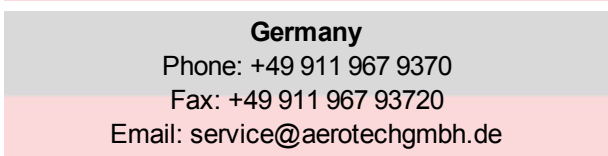
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## Technical Support

Go to [www.aerotech.com/service-and-support.aspx](http://www.aerotech.com/service-and-support.aspx) for information and support about your Aerotech products. The website provides downloadable resources (such as up-to-date software, product manuals, and Help files), training schedules, and PC-to-PC remote technical support. You can also complete Product Return (RMA) forms and get information about repairs and spare or replacement parts.

For immediate help, contact a service office or your sales representative. Have your customer order number available before you call or include it in your email.

 <b>United States</b> (World Headquarters)	Phone: (412) 967-6440 Fax: (412) 967-6870 Email: <a href="mailto:service@erotech.com">service@erotech.com</a>	101 Zeta Drive Pittsburgh, PA 15238 <a href="http://www.aerotech.com">www.aerotech.com</a>
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**NOTE:** Aerotech continually improves its product offerings; listed options may be superseded at any time. Refer to the most recent edition of the Aerotech Motion Control Product Guide for the most current product information at [www.aerotech.com](http://www.aerotech.com).

**NOTE:** All drawings and illustrations are for reference only and were complete and accurate as of this manual's release. The most recent system drawings and schematics can be found on your software CD ROM or on [www.aerotech.com](http://www.aerotech.com).

**NOTE:** This manual and any additional instructions included with the ABL8000 should be read in their entirety before operating the ABL8000 .

**NOTE:** This product is intended for light industrial manufacturing or laboratory use.

**Revision History**      1.00.00      March 12, 2012

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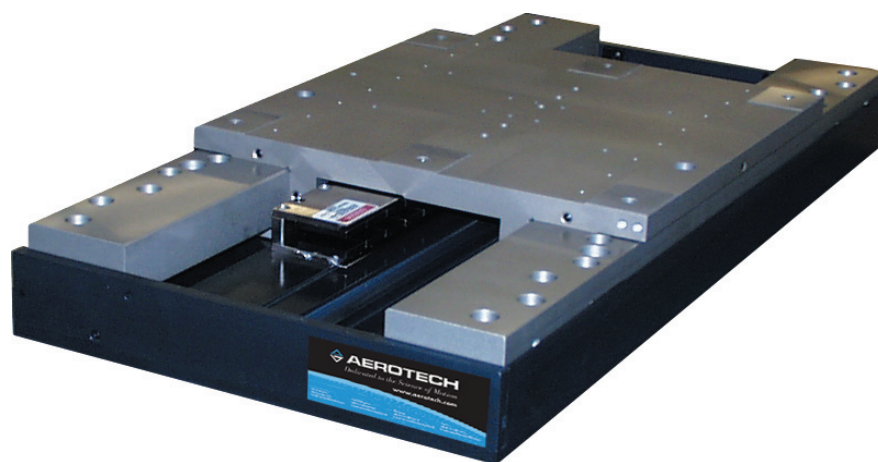


## Chapter 1: Overview

This manual describes Aerotech's ABL8000 series of air bearing positioning stages. [Figure 1-1](#) shows a typical ABL8000 positioning stage.

The ABL8000 series stages supports travel distances ranging from 200 mm to 1000 mm. The -LC construction of the ABL8000 has a long carriage that is optimized for load capacity and stiffness, and it is typically used as the lower axis of an XY stage stack. The -SC construction has a short carriage and is typically used as the upper axis of an XY stage stack due to its lower mass than the -LC construction.

This chapter introduces standard and optional features of the ABL8000 stages, explains the model numbering system, and gives general safety precautions.



**Figure 1-1: Typical ABL8000 Series Positioning Stage**

## 1.1. Standard Features

The ABL8000 stage incorporates completely non-contact air bearing surfaces, linear motors, and feedback devices to provide a minimum maintenance stage. There is no mechanical contact to wear or require lubrication, making these stages ideal for clean room and medical applications.

The ABL8000 incorporates air-on-air preload on both vertical and horizontal surfaces for enhanced bearing stiffness. The wide stance of the ABL8000 coupled with the air-on-air bearing type results in a stage with outstanding stiffness that is ideal for heavy or offset loading.

The brushless linear motor uses an ironlessforcer, which means there is zero cogging and no attractive forces – resulting in unsurpassed smoothness of motion. This is especially useful in applications where velocity control is important.

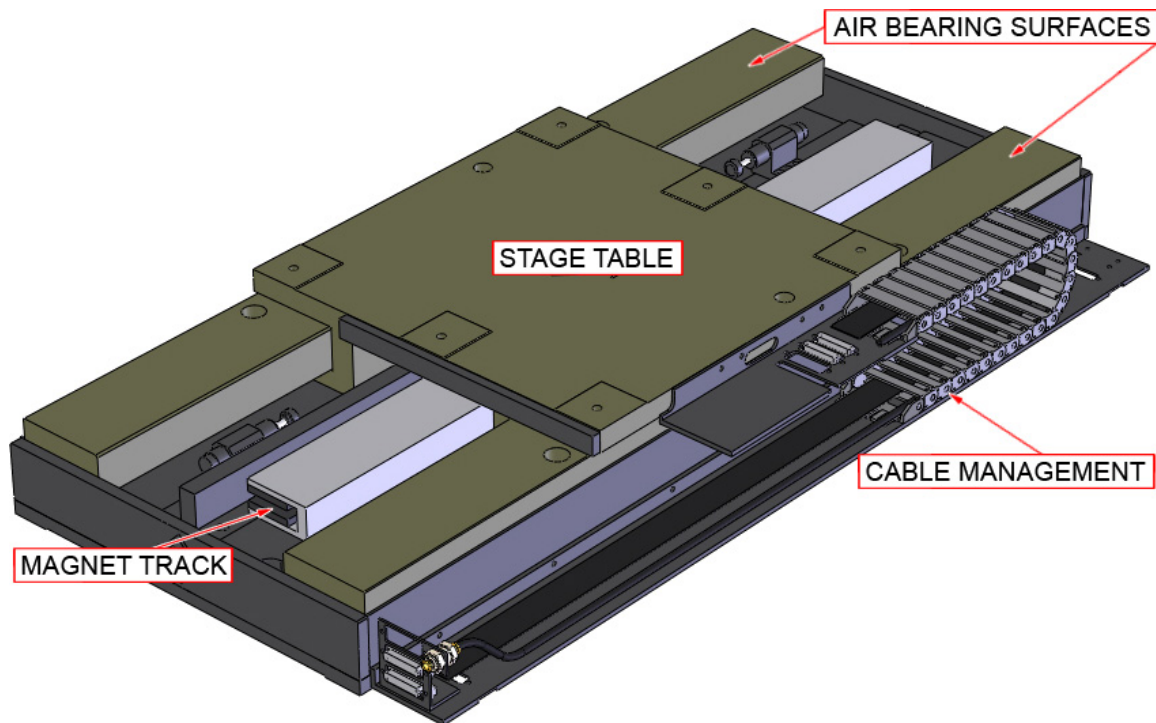


Figure 1-2: ABL8000 Series Stage



### 1.1.1. Optional Features

The ABL8000 can be readily customized to meet the needs of individual applications. Common examples include cable management for stage-mounted payloads, custom tabletops, and granite bases. Contact the Aerotech factory for details.

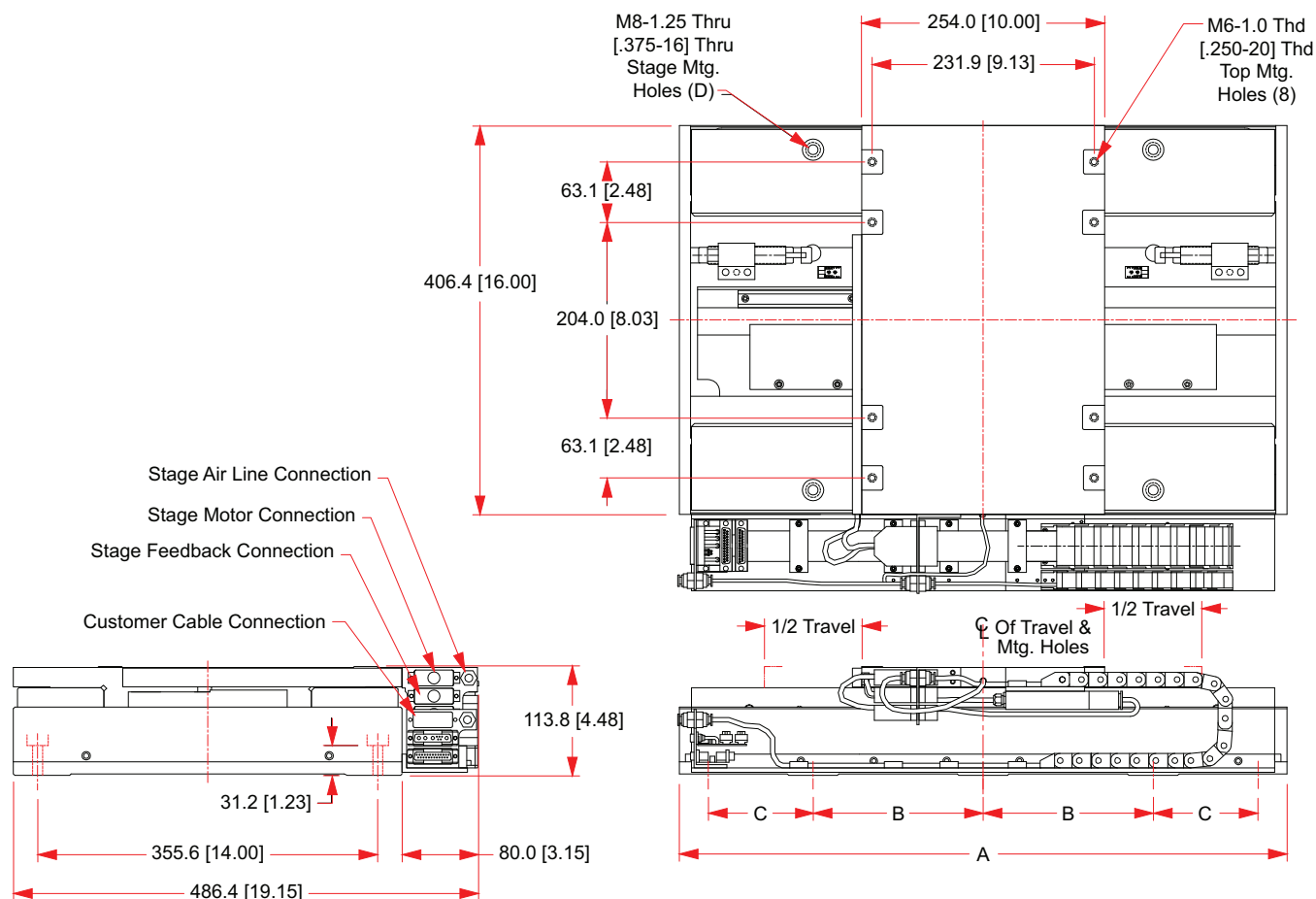
**Table 1-1: Ordering Example (ABL80050-LC-M-P-NC-LN50AS-SINGLE-CMS)**

Series	Travel (mm)	Carriage	Mounting and Grid Pattern	Motor	Limits	Linear Encoder	Options
ABL80	050	-LC	-M	-P	-NC	LN50AS	-SINGLE-CMS

**Table 1-2: Model Numbers and Ordering Options**

ABL8000 Series Linear Air-Bearing Stage	
ABL80020	200 mm (8 in) travel linear air-bearing stage with linear motor and limits
ABL80030	300 mm (12 in) travel linear air-bearing stage with linear motor and limits
ABL80040	400 mm (16 in) travel linear air-bearing stage with linear motor and limits
ABL80050	500 mm (20 in) travel linear air-bearing stage with linear motor and limits
ABL80075	750 mm (30 in) travel linear air-bearing stage with linear motor and limits
ABL80100	1000 mm (40 in) travel linear air-bearing stage with linear motor and limits
Carriage	
-SC	250 mm (10 in) length carriage (single-axis or y-axis use only; requires -5 motor)
-LC	400 mm (16 in) length carriage (required for x-axis in XY configuration; requires -10 motor)
NOTE: When mounting the ABL8000 in an XY configuration, the maximum upper axis length is 400 mm.	
Mounting and Grid Pattern	
-M	Metric dimension mounting pattern and holes
-U	English dimension mounting pattern and holes
Motor	
-P	MT-P magnet track
-S	MT-S magnet track
Limits	
-NC	Normally-closed end of travel limit switches (standard)
-NO	Normally-open end of travel limit switches
Linear Encoders	
-LNAS	Linear encoder, amplified sine output at 4 $\mu$ m fundamental period
-LTAS	High-accuracy linear encoder, amplified sine output at 20 $\mu$ m fundamental period
Options	
-SINGLE-CMS	Cable management system for single-axis applications
-SINGLE-CUST.HOSE	Single CMS; 0.25 inch customer hose
-SINGLE-CUST.CABLE	Single CMS; one customer cable
-SINGLE-CUST.CABLE & HOSE	Single CMS; once customer cable and 0.25 inch hose
-XY-CMS	Cable management system for X-Y assembly; order with each axis
-XY-CUST.HOSE	XY CMS; customer hose
-XY-CUST.CABLE	XY CMS; customer cable
-XY-CUST.CABLE & HOSE	XY CMS; customer cable & hose

## 1.2. Dimensions



BASIC MODEL	TOTAL TRAVEL	DIMENSIONS - MILLIMETERS [INCHES]			
		A	B	C	D
ABL80020-SC	200.0 [8.00]	533.4 [21.00]	177.8 [7.00]	-	6
ABL80030-SC	300.0 [12.00]	635.0 [25.00]	177.8 [7.00]	-	6
ABL80040-SC	400.0 [16.00]	736.6 [29.00]	228.6 [9.00]	-	6
ABL80050-SC	500.0 [16.00]	838.2 [33.00]	228.6 [9.00]	-	6
ABL80075-SC	750.0 [30.00]	1092.2 [43.00]	228.6 [9.00]	285.8 [11.25]	10
ABL80100-SC	1000.0 [40.00]	1346.2 [43.00]	228.6 [9.00]	285.8 [11.25]	10

Figure 1-3: ABL8000 Stage Dimensions (-SC Option)

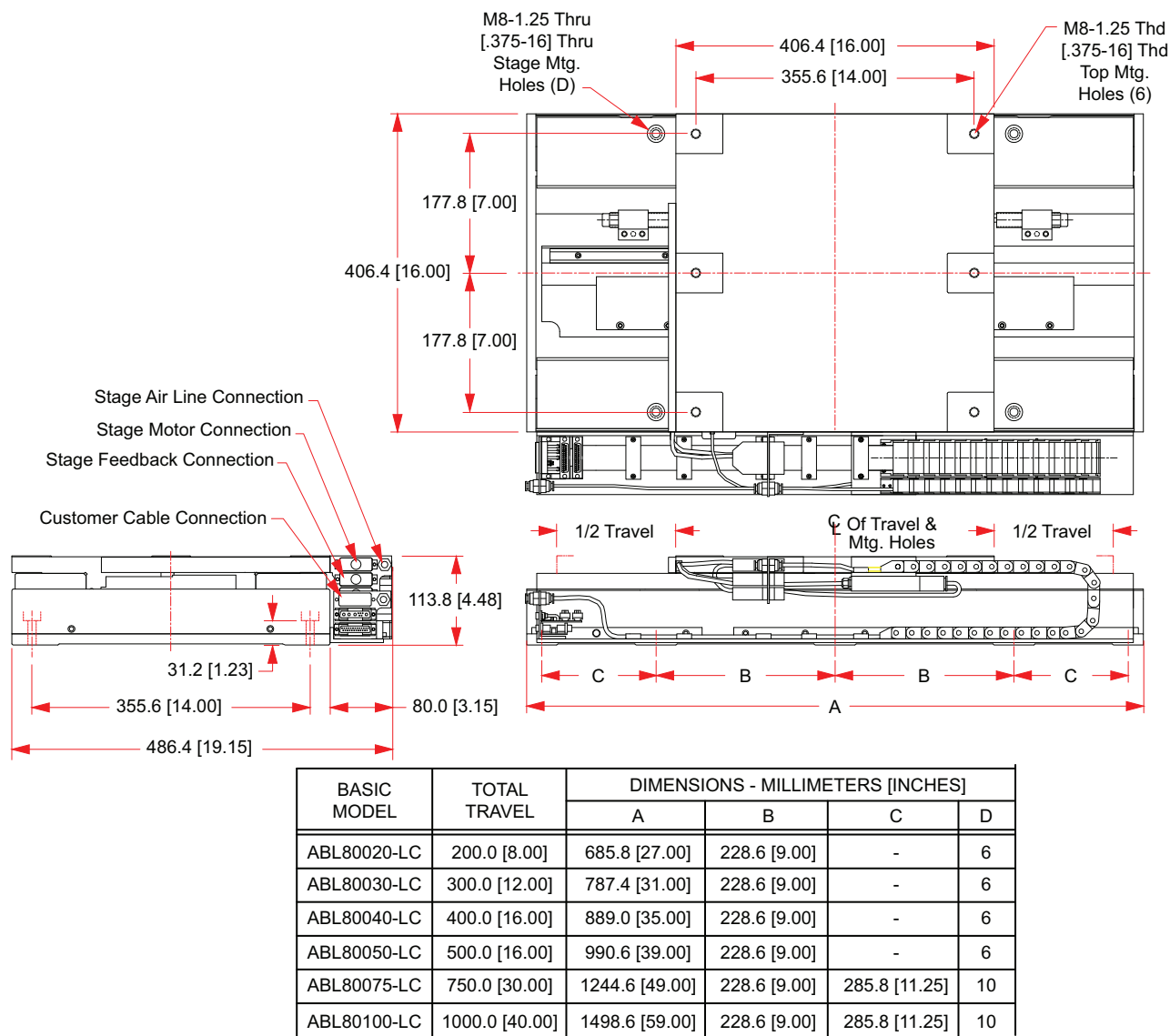


Figure 1-4: ABL8000 Stage Dimensions (-LC Option)

### 1.3. Safety Procedures and Warnings

The following statements apply wherever the Warning or Danger symbol appears within this manual. Failure to observe these precautions could result in serious injury to those individuals performing the procedures and/or damage to the equipment. Operators should be trained before operating this equipment.



**DANGER:** To minimize the possibility of electrical shock and bodily injury or death, disconnect all electrical power prior to making any electrical connections.



**DANGER:** To minimize the possibility of electrical shock and bodily injury or death when any electrical circuit is in use, ensure that no person comes in contact with the circuitry when the ABL8000 is connected to a power source.



**DANGER:** To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.



**DANGER:** Moving parts of the ABL8000 can cause crushing or shearing injuries. All personnel must remain clear of any moving parts.



**WARNING:** If the ABL8000 is used in a manner not specified by the manufacturer, the protection provided by the ABL8000 can be impaired and result in damage, shock, injury or death.



**WARNING:** Cables can pose a tripping hazard. Securely mount and position all ABL8000 cables to avoid potential hazards.



**WARNING:** Do not expose the ABL8000 to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.



**WARNING:** The ABL8000 must be mounted securely. Improper mounting can result in injury and damage to the equipment.



**WARNING:** Use care when moving the ABL8000. Manually lifting or transporting the ABL8000 can result in injury.



**WARNING:** Only trained personnel should operate, inspect, and maintain the ABL8000.



**WARNING:** This ABL8000 is intended for light industrial manufacturing or laboratory use. Use of the ABL8000 for unintended applications can result in injury and damage to the equipment.



**WARNING:** Before using this ABL8000, perform an operator risk assessment to determine the needed safety requirements.

## 1.4. EC Declaration of Incorporation

**Manufacturer:** Aerotech, Inc.  
101 Zeta Drive  
Pittsburgh, PA 15238  
USA



**herewith declares that the product:**

Aerotech, Inc. ABL8000 Stage

**is intended to be incorporated into machinery to constitute machinery covered by the Directive 2006/42/EC as amended;**

**does therefore not in every respect comply with the provisions of this directive;**

**and that the following harmonized European standards have been applied:**

EN ISO 12100-1,-2:2003+A1:2009

*Safety of machinery - Basic concepts, general principles for design*

ISO 14121-1:2007

*Safety of machinery - Risk assessment - Part 1: Principles*

EN 60204-1:2005

*Safety of machinery - Electrical equipment of machines - Part 1: General requirements*

**and further more declares that**

***it is not allowed to put the equipment into service until the machinery into which it is to be incorporated or of which it is to be a component has been found and declared to be in conformity with the provisions of the Directive 2006/42/EC and with national implementing legislation, i.e. as a whole, including the equipment referred to in this Declaration.***

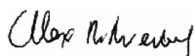
**Authorized Representative:**

Manfred Besold

**Address:**

AEROTECH GmbH  
Süd-West-Park 90  
D-90449 Nürnberg

**Name**

 / Alex Weibel

**Position**

Engineer Verifying Compliance

**Location**

Pittsburgh, PA

**Date**

September 2010



## Chapter 2: Installation

This chapter describes the installation procedure for the ABL8000 stage, including handling the stage, preparing the mounting surface to accept the stage, securing the stage to the mounting surface, attaching the payload, and making the electrical connections.



**WARNING:** Installation must follow the instructions in this chapter. Failure to follow these instructions could result in injury and damage to the equipment.

## 2.1. Unpacking and Handling the Stage

Carefully remove the ABL8000 from the protective shipping container. Before operating the ABL8000, it is important to let the ABL8000 stabilize at room temperature for at least 12 hours. Allowing the ABL8000 to stabilize to room temperature will ensure that all of the alignments, preloads, and tolerances are the same as they were when tested at Aerotech. Use compressed nitrogen or clean, dry, oil-less air to remove any dust or debris that has collected during shipping. Set the ABL8000 on a smooth, flat, and clean surface.

ABL8000 stages come equipped ½"-13 threaded holes in the base for use with eyebolts and lifting straps (not provided). If lifted by hand, the stage should be lifted from the bottom of the base. Do not attempt to lift or move the stage by the table, cable brackets, or end plates. For multi-axis assemblies, always lift the system by the lower axis. Lifting by the upper axis may disturb precision alignments on the system.

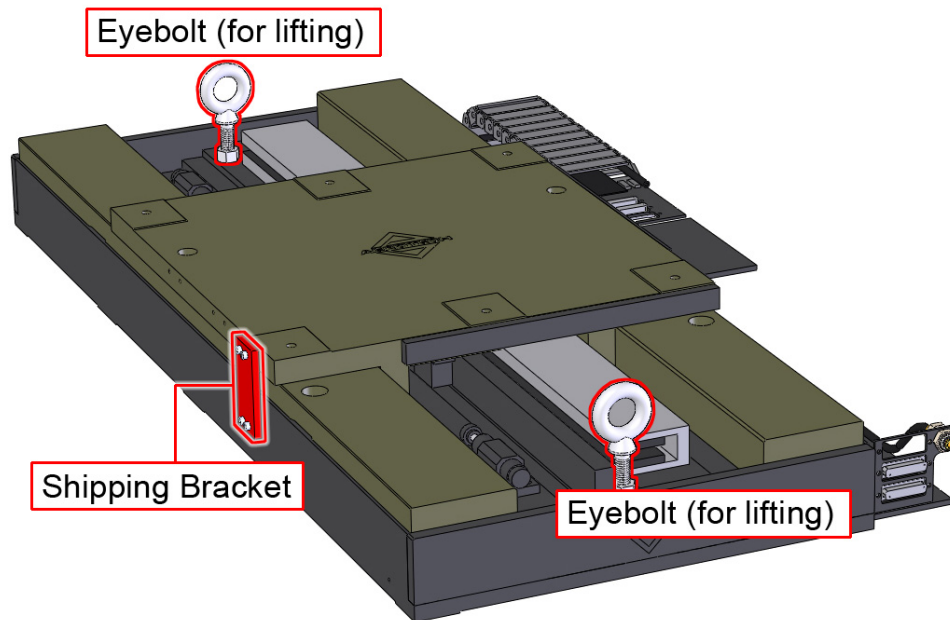


Figure 2-1: Lifting Features

Each ABL8000 has a label listing the system part number and serial number. These numbers contain information necessary for maintaining or updating system hardware and software. Locate this label and record the information for later reference. If any damage has occurred during shipping, report it immediately.



**WARNING:** Improper handling could adversely affect the ABL8000's performance. Use care when moving the stage.



**WARNING:** Do not attempt to move the stage's carriage (or table top) until the air supply, detailed in [Section 2.6](#), has been installed. Moving the carriage without air supplied can cause permanent damage to the stage.



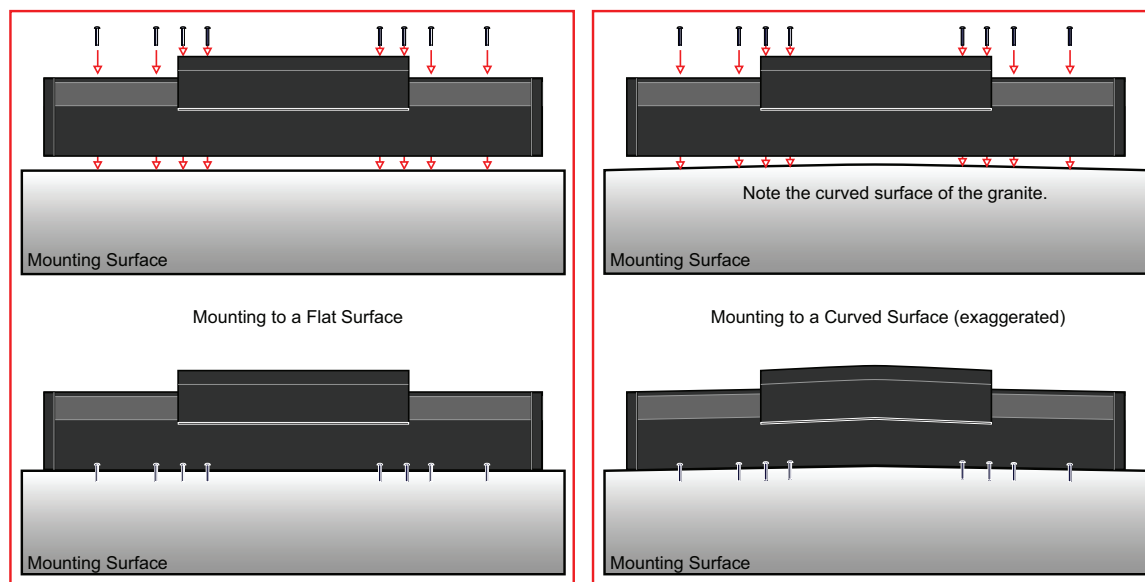
**WARNING:** Do not attempt to move the ABL8000's carriage (or table top) until the shipping brackets have been removed. Moving the carriage with the shipping brackets installed can cause permanent damage to the ABL8000.



## 2.2. Preparing the Mounting Surface

The mounting surface should be flat and have adequate stiffness in order to achieve the maximum performance from the ABL8000. When an ABL8000 stage is mounted to a non-flat surface, the stage can be distorted as the mounting screws are tightened. This distortion will decrease the overall accuracy of the stage. Adjustments to the mounting surface must be done before the stage is secured. The effects of flatness on mounting are illustrated in [Figure 2-2](#).

**NOTE:** To maintain accuracy, the mounting surface should be flat within 1  $\mu\text{m}$  per 150 mm. A laboratory-grade AA granite surface plate is recommended.



**Figure 2-2: Results of Flat Versus Non-Flat Mounting**

**NOTE:** The ABL8000 base is precision machined and verified for flatness prior to product assembly at the factory. If machining is required to achieve the desired flatness, it should be performed on the mounting surface rather than the ABL8000 base. Shimming should be avoided if possible. If shimming is required, it should be minimized to improve the rigidity of the system.

## 2.3. Securing the Stage to the Mounting Surface



**DANGER:** Strong rare-earth magnets are present in the linear motor magnet track. Loose metal objects (tools, watches, keys, etc.) may cause personal injury and/or damage to the equipment.



**WARNING:** The ABL8000 must be mounted securely. Improper mounting can result in injury and damage to the equipment.

Procedure for ABL8000 mounting:

1. Prepare the stone mounting surface and bottom of the stage base with precision flatstones to remove any burrs or high spots.
2. Clean the mounting surface and bottom of the stage with the appropriate cleaners (acetone or isopropyl alcohol for the stage bottom).
3. Place the stage on the mounting surface
4. Remove the lifting brackets and shipping bracket (Figure 2-1)
5. Turn on the air supply to the air bearing.



**WARNING:** Do not attempt to move the stage's carriage (or table top) until the air supply, detailed in Section 2.6, has been installed. Moving the carriage without air supplied can cause permanent damage to the stage.

6. Slide the air bearing carriage to one end of travel and screw down with M6 (or ¼-20) socket head cap screws and flat washers in the exposed mounting locations. Do not fully tighten at this time, but bring within 1/4 turn of screw head engagement

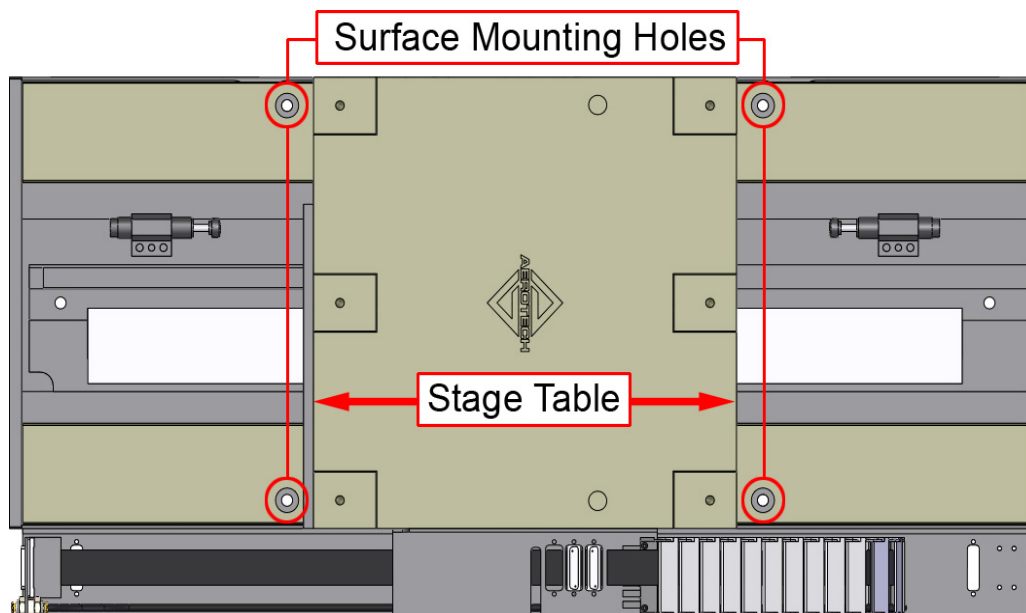
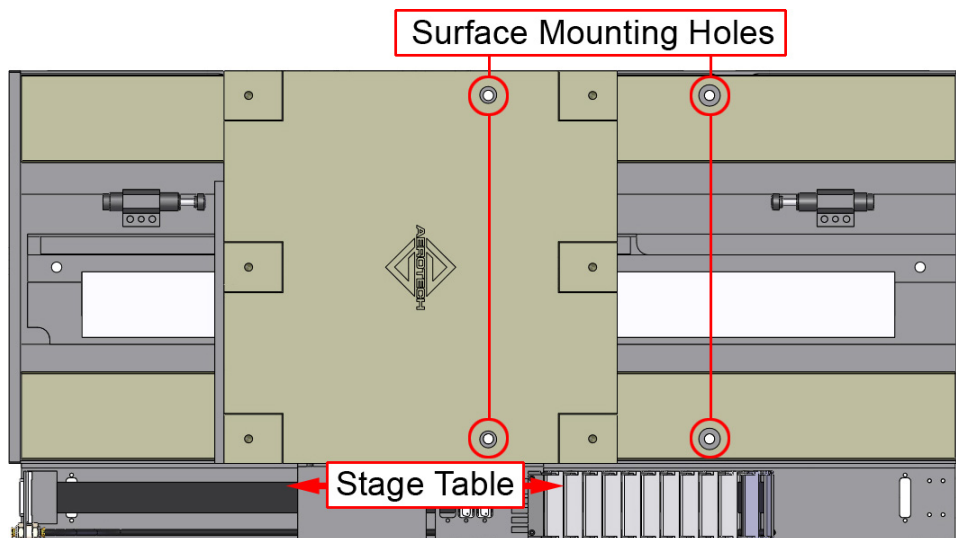


Figure 2-3: Surface Mounting Screws

7. Slide the air-bearing carriage to the opposite end of travel and install the stage mounting screws in the exposed mounting holes. As in step 6, do not tighten the screws yet, but bring within 1/4 turn of

engagement

8. For some travel lengths, the central mounting points of the stage base might need to be accessed through holes in the stage carriage. Slide the carriage to expose the central mounting holes and insert the mounting screws and washers.



**Figure 2-4: Mounting Holes in the Stage Table**

9. Tighten the mounting screws (begin from the center out for best accuracy). The usual torque value for M6 socket head cap screws is 8 N-m .

## 2.4. Attaching the Payload to the Stage

To prevent damage to payloads, test the operation of the stage before the payload is attached to the stage table. Proceed with the electrical installation and test the motion control system in accordance with the system documentation. Document all results for future reference. For information on electrical connections, refer to [Section 2.5](#) and the documentation delivered with the stage.

The payload should be flat, rigid, and comparable to the stage in quality.

**NOTE:** For valid system performance, the mounting interface should be flat within 1  $\mu\text{m}$  per 50 mm.

## 2.5. Electrical Installation

Aerotech motion control systems are adjusted at the factory for optimum performance. When the ABL8000 is part of a complete Aerotech motion control system, setup usually involves connecting a stage to the appropriate drive chassis with the cables provided. Labels on the system components usually indicate the appropriate connections.

Refer to the appropriate system manuals and documentation for additional installation and operation information. If the system is uniquely configured, a drawing showing system interconnects is supplied.

See [Section 3.6](#) for standard wiring pin assignments.



**WARNING:** Never connect or disconnect any electrical component or connecting cable while power is applied, or serious damage can result.



**WARNING:** Refer to [Section 3.6](#) for the location of the ABL8000's protective ground. If you are using cables other than those provided by Aerotech, you must connect the ground pins to a ground connection.

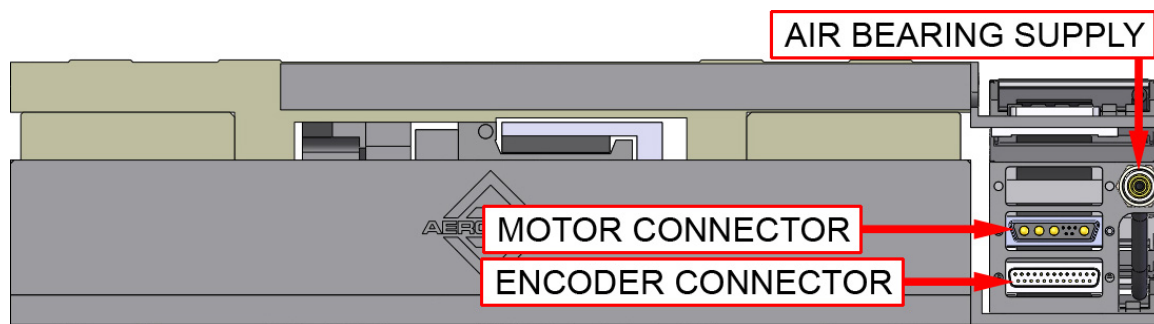
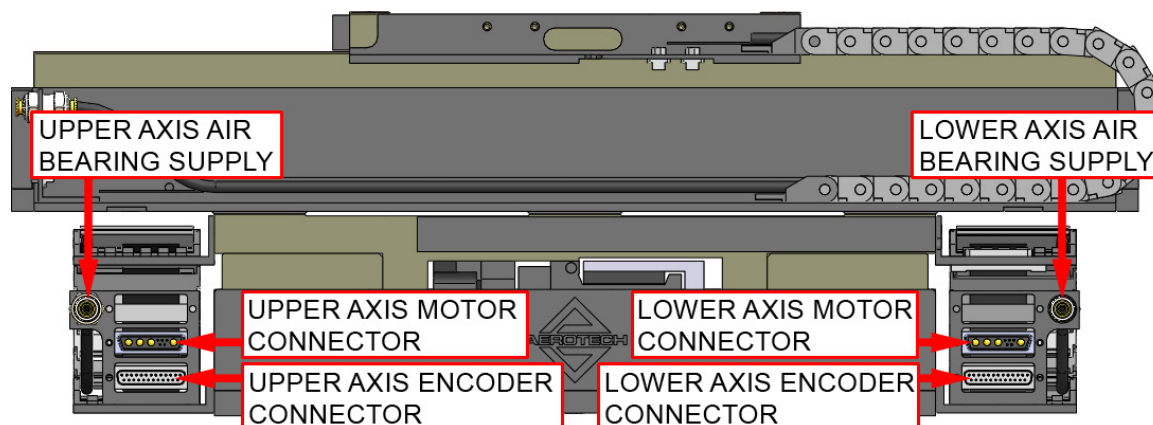
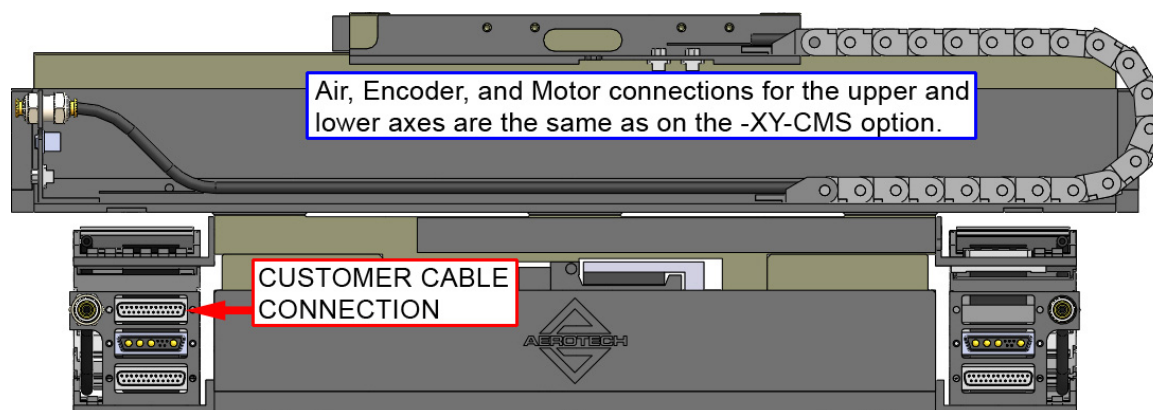


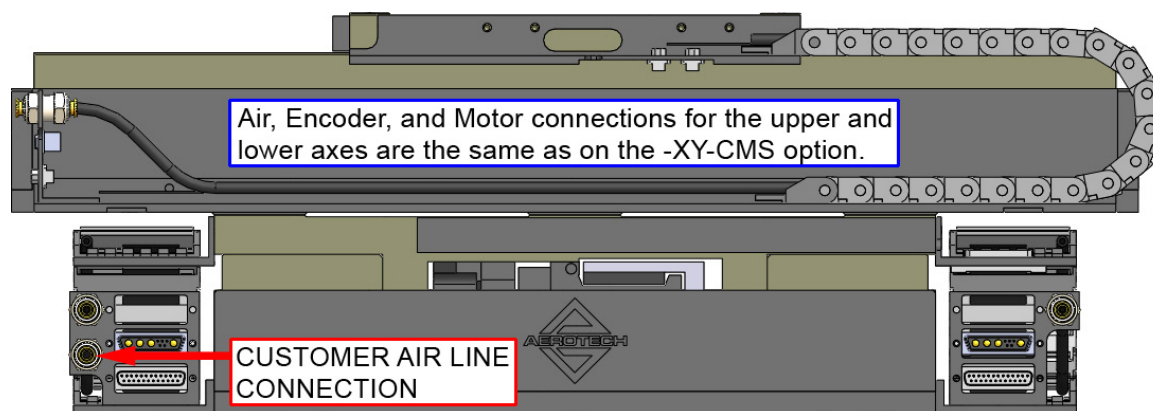
Figure 2-5: Motor and Feedback Connections (-SINGLE-CMS option)



**Figure 2-6: Motor and Feedback Connections (-XY-CMS option)**



**Figure 2-7: Motor and Feedback Connections (-XY-CMS Customer Cable option)**



**Figure 2-8: Motor and Feedback Connections (-XY-CMS Customer Hose option)**

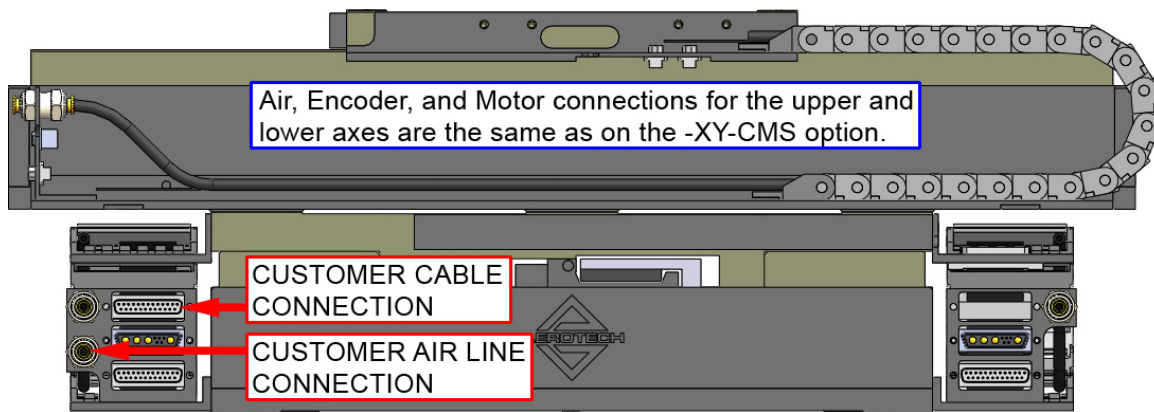


Figure 2-9: Motor and Feedback Connection (-XY-CMS Customer Cable & Hose option)

## 2.6. Air Requirements

The air supply to the air bearing is important for the operation of the system. If compressed air is used, it must be filtered to 0.25 microns, dry to 0°F dewpoint, and oil free. If nitrogen is used, it must be 99.99% pure and filtered to 0.25 microns. The filtration requirement is to prevent particles from clogging the air bearing orifices. It is necessary to supply air pressure in the range of 517 kPa to 551 kPa (75 psi to 80 psi). Air should be supplied through a 1/4" outside diameter polyurethane air hose.

A pressure switch should be installed to remove power from the air bearing if pressure drops below 40 psi to prevent damage to the bearing surfaces.

For the -SC construction, an airflow rate of between 30 to 36 SLPM (standard liters per minute) at 551 kPa should be observed (single axis). For the -LC construction, an airflow rate of between 48 to 53 SLPM (standard liters per minute) at 551 kPa should be observed (single axis).

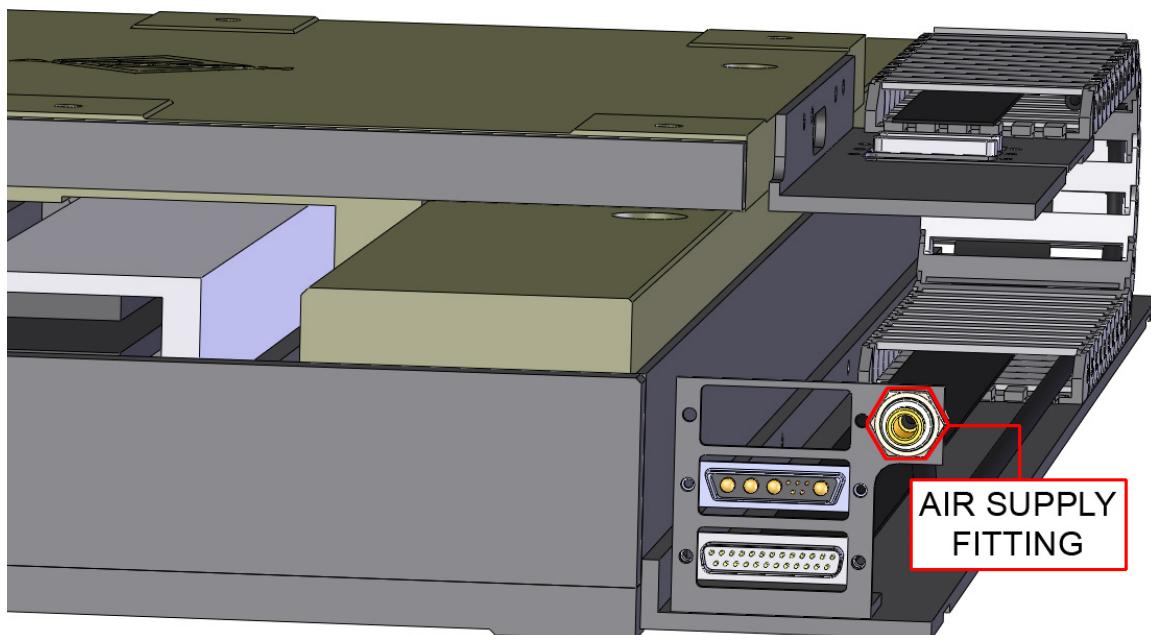


Figure 2-10: Air Fitting Location

## Chapter 3: Operating Specifications

The surrounding environment and operating conditions can affect the performance and service life of the ABL8000. This chapter contains general technical information on ideal environmental, operating, and basic product specifications.

### 3.1. Environmental Specifications

The environmental specifications are listed in the table below.

**Table 3-1: Environmental Specifications**

<b>Ambient Temperature</b>	Operating: 16° to 25° C (61° to 77° F) The optimal operating temperature is 20° C $\pm$ 2° C (68° F $\pm$ 4° F). If at any time the operating temperature deviates from 20° C degradation in performance could occur. Contact Aerotech for information regarding your specific application and environment.
	Storage: 0° to 40° C (32° to 104° F) in original shipping packaging
<b>Humidity</b>	Operating: 40 percent to 60 percent RH The optimal operating humidity is 50 percent RH.
	Storage: 30 percent to 60 percent RH, non-condensing in original packaging
<b>Altitude</b>	Operating: 0 to 2,000 m (0 to 6,562 ft) above sea level Contact Aerotech if your specific application involves use above 2,000 m or below sea level.
<b>Vibration</b>	Use the system in a low vibration environment. Contact Aerotech for information regarding your specific application.
<b>Dust Exposure</b>	ABL8000 stages are not suited to dusty or wet environments. This equates to an ingress protection rating of IP00.
<b>Use</b>	Indoor use only



**WARNING:** Do not expose the stage to environments or conditions outside the specified range of operating environments. Operation in conditions other than those specified can cause damage to the equipment.

### 3.2. Accuracy and Temperature Effects

Due to the small clearances in the air-bearing design, extreme temperature environments could cause a decrease in performance or permanent damage to the stage. Standard Aerotech air-bearing stages are designed for and built in a 20°C (68°F) environment.

Stage travel changes linearly with temperature. The thermal expansion coefficient for the encoder used for the ABL8000 stages is 7.5 ppm per °C.

### 3.3. Basic Specifications

For the most recent specifications, see [www.aerotech.com](http://www.aerotech.com).

**Table 3-2: Series Specifications (ABL80020 - ABL80040)**

		ABL80020	ABL80030	ABL80040
Travel <sup>(2)</sup>		200 mm	300 mm	400 mm
Accuracy <sup>(1)</sup>	LN Standard	$\pm 5.0 \mu\text{m}$ [ $\pm 200 \mu\text{in}$ ]		
	LT Standard	$\pm 8.0 \mu\text{m}$ [ $\pm 315 \mu\text{in}$ ]	$\pm 11.5 \mu\text{m}$ [ $\pm 453 \mu\text{in}$ ]	$\pm 14.0 \mu\text{m}$ [ $\pm 551 \mu\text{in}$ ]
	HALAR <sup>(7)</sup>	$\pm 0.5 \mu\text{m}$ [ $\pm 20 \mu\text{in}$ ]	$\pm 0.5 \mu\text{m}$ [ $\pm 20 \mu\text{in}$ ]	$\pm 0.75 \mu\text{m}$ [ $\pm 30 \mu\text{in}$ ]
Repeatability (Bi-Directional) <sup>(1)</sup>		$\pm 0.2 \mu\text{m}$ [ $\pm 8 \mu\text{in}$ ]	$\pm 0.2 \mu\text{m}$ [ $\pm 8 \mu\text{in}$ ]	$\pm 0.2 \mu\text{m}$ [ $\pm 8 \mu\text{in}$ ]
Straightness <sup>(1)</sup>		$\pm 0.4 \mu\text{m}$ [ $\pm 16 \mu\text{in}$ ]	$\pm 0.75 \mu\text{m}$ [ $\pm 30 \mu\text{in}$ ]	$\pm 1.5 \mu\text{m}$ [ $\pm 60 \mu\text{in}$ ]
Flatness <sup>(1)</sup>		$\pm 0.4 \mu\text{m}$ [ $\pm 16 \mu\text{in}$ ]	$\pm 0.75 \mu\text{m}$ [ $\pm 30 \mu\text{in}$ ]	$\pm 1.5 \mu\text{m}$ [ $\pm 60 \mu\text{in}$ ]
Pitch		2 arcsec	3 arcsec	4 arcsec
Roll		2 arcsec	3 arcsec	4 arcsec
Yaw		2 arcsec	3 arcsec	4 arcsec
Maximum Speed <sup>(3)</sup>	LN	1.2 m/s [45 in/s]		
	LT	2.0 m/s [80 in/s]		
Maximum Acceleration		2 g - 20 m/s <sup>2</sup> [768 in/s <sup>2</sup> ] (no-load)		
Maximum Force <sup>(5,6)</sup> (continuous)	-SC	110.5 N [24.8 lb] (-P motor option)		
	-LC	197.2 N [44.3 lb] (-P motor option)		
Load Capability <sup>(4)</sup>	Horiz. (-SC)	70 kg [154 lb]		
	Side (-SC)	30 kg [66 lb]		
	Horiz. (-LC)	120 kg [264 lb]		
	Side (-LC)	50 kg [110 lb]		
Operating Pressure <sup>(9)</sup>		517 kPa ~ 551 kPa [75 psi ~ 80 psi]		
Air Consumption <sup>(10)</sup>	-SC	< 36 SLPM [1.3 SCFM] per axis		
	-LC	< 58 SLPM [2.0 SCFM] per axis		
Moving Mass	-SC	10 kg [22 lb]		
	-LC	16 kg [35 lb]		
Stage Mass	-SC	55 kg [121 lb]	62 kg [137 lb]	70.5 kg [155 lb]
	-LC	70 kg [154 lb]	77 kg [170 lb]	85.5 kg [188 lb]
Material		Aluminum		
Mean Time Before Failure		30,000 Hours		

(1) Certified with each stage.

(2) Max upper axis length in XY configuration is 400 mm.

(3) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.

(4) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements

(5) Thermal limitations of positioning stage with respect to performance may limit continuous force output.

(6) Force may be limited by amplifier output.

(7) Available with Aerotech controllers.

(8) Requires environmental compensation.

(9) To protect air bearing against under-pressure, an in-line pressure switch tied to controller ESTOP input is recommended.

(10) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25  $\mu\text{m}$  or better; recommend nitrogen at 99.9% purity.

(11) Specifications are for single-axis systems, measured 50 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.



**Table 3-3: Series Specifications (ABL80050 - ABL80100)**

		ABL80050	ABL80075	ABL80100
Travel <sup>(2)</sup>		500 mm	750 mm	1000 mm
Accuracy <sup>(1)</sup>	LN Standard	±5.0 µm [±200 µin]	±6.0 µm [±240 µin]	±7.0 µm [±280 µin]
	LT Standard	±15.75 µm [±620 µin]	±18.5 µm [±728 µin]	±20.0 µm [±787 µin]
	HALAR <sup>(7)</sup>	±0.75 µm [±30 µin]	±1.0 µm [±40 µin]	±1.0 µm [±40 µin]
Repeatability (Bi-Directional) <sup>(1)</sup>		±0.3 µm [±12 µin]	±0.4 µm [±16 µin]	±0.4 µm [±16 µin]
Straightness <sup>(1)</sup>		±2.0 µm [±80 µin]	±3.0 µm [±120 µin]	±4.0 µm [±160 µin]
Flatness <sup>(1)</sup>		±2.0 µm [±80 µin]	±3.0 µm [±120 µin]	±4.0 µm [±160 µin]
Pitch		5 arcsec	7.5 arcsec	10 arcsec
Roll		5 arcsec	7.5 arcsec	10 arcsec
Yaw		5 arcsec	7.5 arcsec	10 arcsec
Maximum Speed <sup>(3)</sup>	LN	1.2 m/s [45 in/s]		
	LT	2.0 m/s [80 in/s]		
Maximum Acceleration		2 g - 20 m/s <sup>2</sup> [768 in/s <sup>2</sup> ] (no-load)		
Maximum Force <sup>(5,6)</sup> (continuous)	-SC	110.5 N [24.8 lb] (-P motor option)		
	-LC	197.2 N [44.3 lb] (-P motor option)		
Load Capability <sup>(4)</sup>	Horiz. (-SC)	70 kg [154 lb]		
	Side (-SC)	30 kg [66 lb]		
	Horiz. (-LC)	120 kg [264 lb]		
	Side (-LC)	50 kg [110 lb]		
Operating Pressure <sup>(9)</sup>		517 kPa ~ 551 kPa [75 psi ~ 80 psi]		
Air Consumption <sup>(10)</sup>	-SC	< 36 SLPM [1.3 SCFM] per axis		
	-LC	< 58 SLPM [2.0 SCFM] per axis		
Moving Mass	-SC	10 kg [22 lb]		
	-LC	16 kg [35 lb]		
Stage Mass	-SC	78.5 kg [173 lb]	98 kg [216 lb]	116.5 kg [257 lb]
	-LC	93.5 kg [206 lb]	113 kg [249 lb]	131.5 kg [290 lb]
Material		Aluminum		
Mean Time Before Failure		30,000 Hours		

(1) Certified with each stage.

(2) Max upper axis length in XY configuration is 400 mm.

(3) Maximum speed based on stage capability; maximum application velocity may be limited by system data rate and system resolution.

(4) Maximum load based on bearing capability; maximum application load may be limited by acceleration requirements

(5) Thermal limitations of positioning stage with respect to performance may limit continuous force output.

(6) Force may be limited by amplifier output.

(7) Available with Aerotech controllers.

(8) Requires environmental compensation.

(9) To protect air bearing against under-pressure, an in-line pressure switch tied to controller ESTOP input is recommended.

(10) Air supply must be clean, dry to 0° F dewpoint and filtered to 0.25 µm or better; recommend nitrogen at 99.9% purity.

(11) Specifications are for single-axis systems, measured 50 mm above the tabletop. Performance of multi-axis systems is payload and workpoint dependent. Consult factory for multi-axis or non-standard applications.

**Table 3-4: Electrical Specifications**

Drive System	-SC	BLM-142-A
	-LC	BLM-264-A
Feedback	-LN	Incremental encoder, 4 $\mu$ m fundamental period
	-LT	Incremental encoder, 20 $\mu$ m fundamental period
Electronic Resolution		See signal period options on Order Information page
Maximum Bus Voltage		80
Limit Switches		5V, Normally Open
Home Switch		Near Center

**Table 3-5: Recommended Controller**

Multi Axis	A3200/	Ndrive MP / Ndrive CP / Ndrive HLe / Npaq MXR
	Ensemble	Ensemble MP / Ensemble CP / Ensemble HLe / Epaq
Single Axis	Soloist	SoloistMP / Soloist CP / Soloist HLe

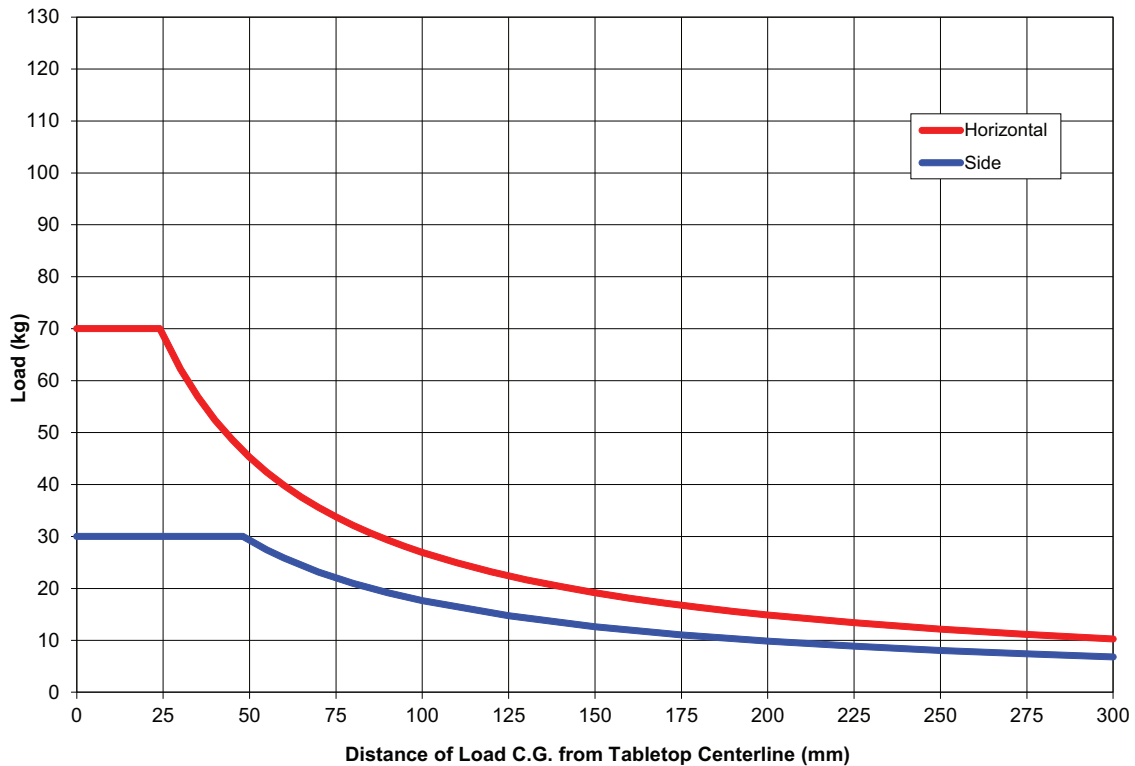
**Table 3-6: ABL8000 Series Motor Specifications**

Model	BLM-142	BLM-264
Winding Designation	-A	-A
<b>Performance Specifications <sup>(1,5)</sup></b>		
Continuous Force, 20 psi, 1.4 bar <sup>(2)</sup>	173.2 N [38.9 lb]	301.7 N [67.8 lb]
Continuous Force (no forced cooling) <sup>(2)</sup>	110.5 N [24.8 lb]	197.2 N [44.3 lb]
Peak Force <sup>(3)</sup>	692.7 N [155.7 lb]	1206.6 N [271.3 lb]
<b>Electrical Specifications <sup>(5)</sup></b>		
BEMF Constant (line to line, max)	40.96 V/(m/s) [1.04 V/(in/s)]	44.46 V/(m/s) [1.13 V/(in/s)]
Continuous Current, 20 psi, 1.4 bar <sup>(2)</sup>	4.86 Amp (pk)	7.80 Amp (pk)
	3.44 Amp (rms)	5.52 Amp (rms)
Continuous Current (no forced cooling) <sup>(2)</sup>	3.10 Amp (pk)	5.10 Amp (pk)
	2.19 Amp (rms)	3.61 Amp (rms)
Peak Current, Stall <sup>(3)</sup>	19.44 Amp (pk)	31.20 Amp (pk)
	13.75 Amp (rms)	22.06 Amp (rms)
Force Constant, Sine Drive <sup>(4,8)</sup>	35.63 N/Amp (pk) [8.01 lb/Amp (pk)]	38.67 N/Amp (pk) [8.69 lb/Amp (pk)]
	50.39 N/Amp (rms) [11.33 lb/Amp (rms)]	54.69 N/Amp (rms) [12.30 lb/Amp (rms)]
Motor Constant <sup>(2,4)</sup>	10.53 N/ $\sqrt{W}$ [2.37 lb/ $\sqrt{W}$ ]	16.39 N/ $\sqrt{W}$ [3.69 lb/ $\sqrt{W}$ ]
Resistance, 25 °C (line-line)	10.9 ohms	5.3 ohms
Inductance (line-line)	8.70 mH	4.20 mH
Thermal Resistance, 20 psi, 1.4 bar	0.37 °C/W	0.30 °C/W
Thermal Resistance (no forced cooling)	0.91 °C/W	0.69 °C/W
Maximum Bus Voltage	340 VDC	340 VDC
<p>(1) Performance is dependent upon heat sink configuration, system cooling conditions, and ambient temperature</p> <p>(2) Values shown @ °C rise above a 25 °C ambient temperature</p> <p>(3) Peak force assumes correct rms current; consult Aerotech.</p> <p>(4) Force constant and motor constant specified at stall.</p> <p>(5) All performance and electrical specifications +/- 10%</p> <p>(6) Maximum winding temperature is °C</p> <p>(7) Ambient operating temperature range: 0 °C - 25 °C, consult Aerotech for performance in elevated ambient temperatures</p> <p>(8) All Aerotech amplifiers are rated Apk; use torque constant in N-m / Apk when sizing</p>		

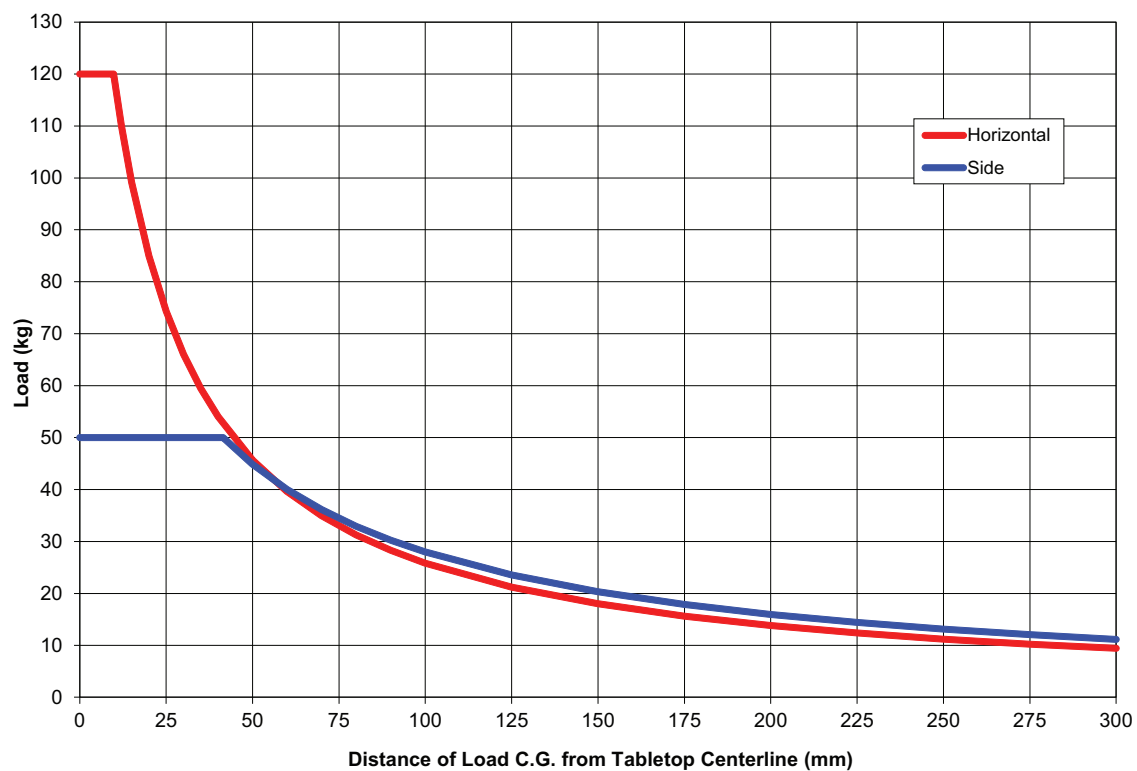
### 3.4. Load Capability

Application loads should be symmetrically distributed whenever possible. The payload should be centered on the stage table and the entire stage should be centered on the support structure. With the stage lying flat (horizontal) and the application load vertically applied and symmetrically distributed, the maximum vertical load carrying capacity is kg for ABL8000-SC stages and 120 kg for ABL8000-LC stages.

If cantilevered loads are applied, refer to [Figure 3-1](#) or [Figure 3-2](#) to find the maximum allowable load.



**Figure 3-1: Cantilevered Load Capability (-SC Construction)**



**Figure 3-2: Cantilevered Load Capability (-LC Construction)**

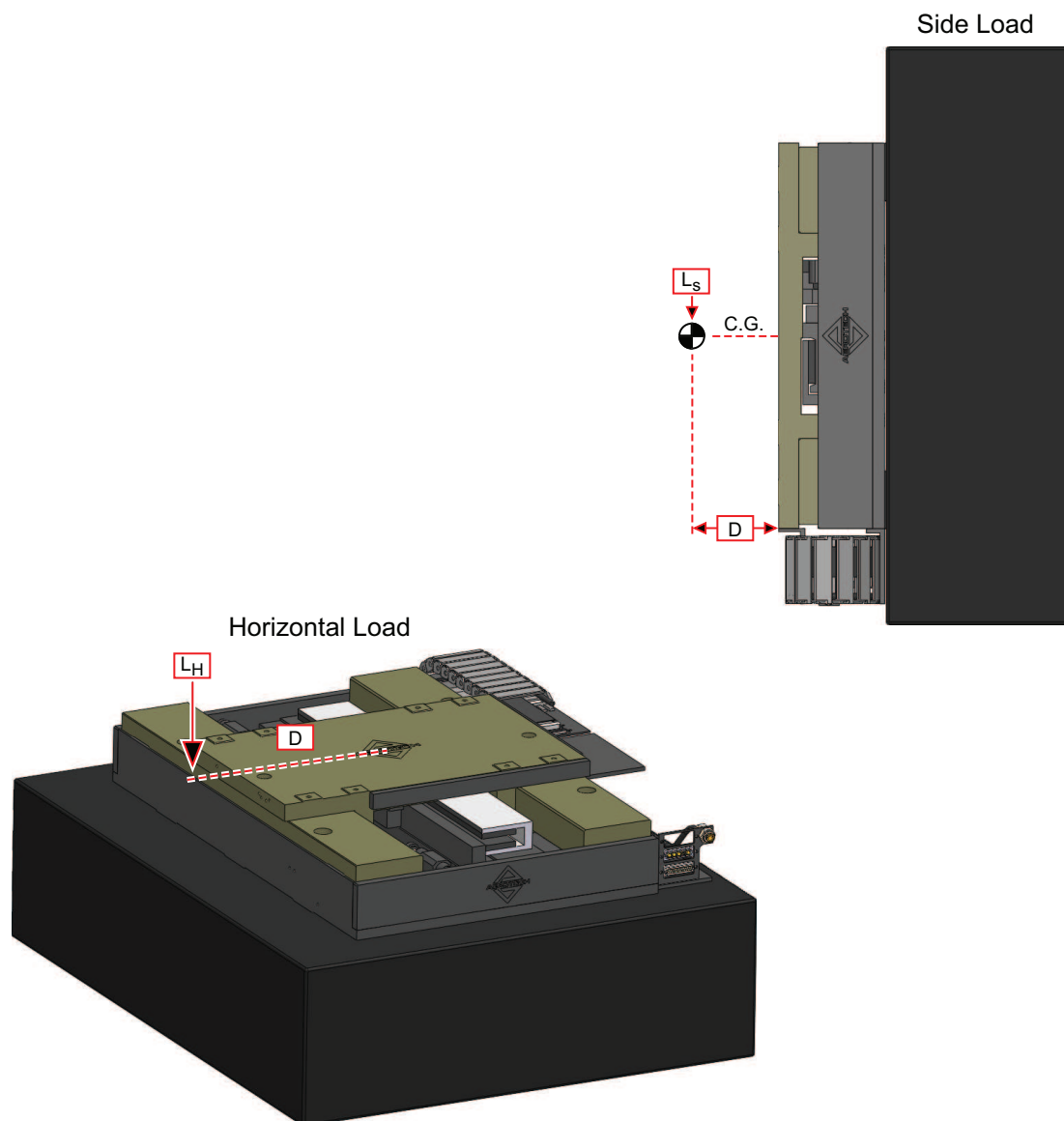


Figure 3-3: Cantilever Length Diagram

### 3.5. End of Travel Limits

ABL8000 series stages are provided with End of Travel (EOT) limits. These limits indicate to the motion controller when the stage has reached its maximum useable travel in each direction.

#### 3.5.1. Limit Switch Operation

EOT limits are integral to the encoder feedback read head and integrated into the feedback connector. These outputs change state when the stage approaches its maximum travel distance and signals the motion controller. The ABL8000 stage limits operate as normally-closed (N.C.) current sinking outputs.



**WARNING:** If the ABL8000 is driven 3.5 mm beyond the electrical limit, it will encounter a mechanical stop. The shock absorber will attempt to slow the stage over an approximately 19 mm stroke before contacting the mechanical stop. Although the operating speed of the ABL8000 may be relatively slow, impacting the mechanical stop could cause damage to the stage.

#### 3.5.2. Limit Switch Wiring

Limit switches are open-collector, TTL-compatible, electro-optical devices powered by 5 Volts that change output states when the stage approaches its maximum travel distance and breaks the light beam. Since they are open-collector devices, they may be interfaced to 24Volt logic inputs. Each limit switch is mounted on a small printed circuit board. Standard stages include limit switch wiring integrated into the feedback connector.

Assuming an NC limit configuration, the input to the controller is seen as a logic 0 (usually 0.4V @ 12.8mA) when no limit condition is present. When the limit switch is activated, a 5V source through a pull-up resistor causes a logic 1 (usually 4.8-5V) to be seen by the controller input. The limit switch operation for a NO limit configuration is the exact opposite as described above. See [Figure 3-4](#) for a diagram of limit switch wiring.

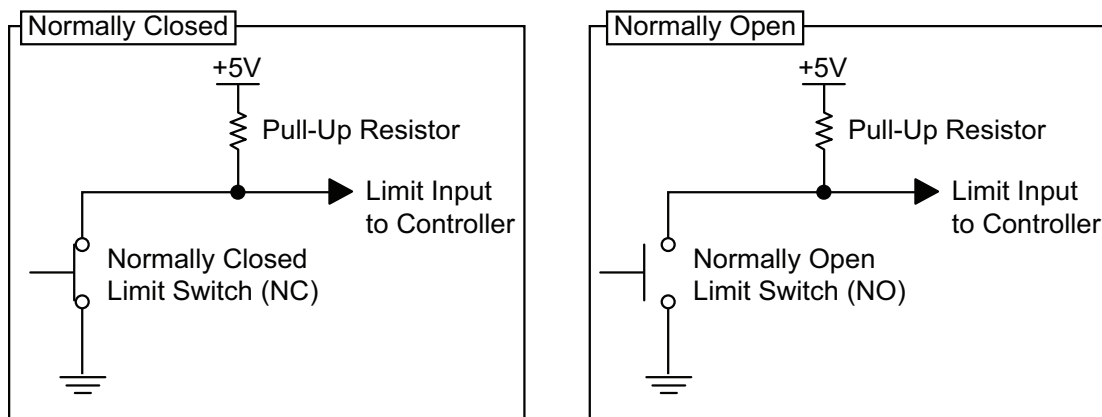


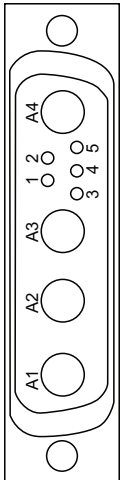
Figure 3-4: Normally Closed (NC) and Normally Open (NO) Limit Switch Wiring

### 3.6. Standard Motor Wiring

The ABL8000 comes from the factory completely wired and assembled. Each ABL8000 is shipped with documentation regarding the wiring, controller interface connectors, and specifications.

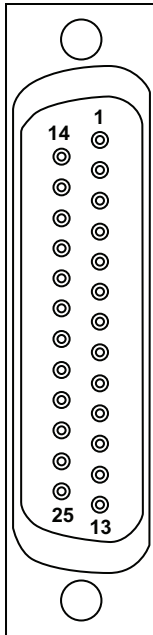
**NOTE:** If you are using your own cables to connect the stage, ensure that motor and ground wires can handle current higher than the continuous motor current listed in [Section 3.3](#). The voltage rating of the wire insulation must be greater than the motor bus voltage listed in [Section 3.3](#).

**Table 3-7: Motor Connector Pin Assignments**

Pin	Description	Connector
A1	MTR ØA (Motor Phase A)	
A2	MTR ØB (Motor Phase B)	
A3	MTR ØC (Motor Phase C)	
1	Shield for motor wiring connector	
2	Reserved: Not Used	
3	Reserved: Not Used	
4	Reserved: Not Used	
5	Reserved: Not Used	
A4	Ground to stage base	



**Table 3-8: Feedback Connector Pin Assignments**

Pin	Label	Description	Connector
1	SIG SHLD	Signal shield connection	
2	Thermistor	Positive lead for motor thermistor (to motion controller).	
3	Encoder +5V	+5 V supply input for optical encoders (the typical requirement is 250 mA).	
5	HALL B	Hall Effect B. Brushless motor commutation track output. TTL line driven signal with rotary motor.	
6	MKR-N	Incremental encoder output; the compliment of Marker	
7	MKR	Marker. Incremental encoder output pulse produced once per travel length. Usually used for home reference cycle.	
10	HALL A	Hall Effect A. Brushless motor commutation track output. TTL line driven signal with rotary motor.	
11	HALL C	Hall Effect C. Brushless motor commutation track output. TTL line driven signal with rotary motor.	
12	+Limit / CW	Signal indicating maximum travel produced by positive/CW stage direction.	
14	COS	Cosine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.	
15	COS-N	Incremental encoder output; the compliment of COS	
16	Limit +5V	+5V supply input for optical limit switch boards (the typical requirement is 50 mA).	
17	SIN	Sine. Incremental encoder output; either TTL line driven or amplified sine wave type signal.	
18	SIN-N	Incremental encoder output; the compliment of SIN.	
20	Limit Common	Common ground to limit switch.	
21	Encoder Common	Common ground to encoder power.	
24	-Limit / CCW	Signal indicating maximum travel produced by positive/CW stage direction.	

### 3.7. Vacuum Operation

The ABL8000 is an air-bearing stage and is not compatible with operation in a vacuum environment. Contact Aerotech for alternate solutions.



## Chapter 4: Maintenance

These stages are designed to be maintenance free positioning systems. Due to the non-contact air bearing design, there are no friction surfaces or dynamic seals to wear or require lubrication. However, it is important to clean the bearing surfaces and encoder strips to maintain the accuracy of the stage. This chapter will detail the cleaning process and specify recommended cleaning solvents.

**NOTE:** The bearing area must be kept free of foreign matter and moisture; otherwise, the performance and life expectancy of the stage will be reduced. Refer to [Section 2.6](#) for air requirements.



**DANGER:** To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.

### 4.1. Service and Inspection Schedule

Aerotech recommends that the ABL8000 stage be inspected once per month until a trend develops for the specific application and environment.

### 4.2. Cleaning and Lubrication

There are no elements on the ABL8000 that require lubrication. Periodic cleaning to remove dust is recommended.

#### 4.2.1. Recommended Cleaning Solvents

Before using a cleaning solvent on any part of the stage, it is recommended that clean, dry compressed air is used to blow away small particles and dust. All encoder surfaces and magnet tracks should be cleaned with isopropyl alcohol. Aluminum hard-coated metal surface may be cleaned with acetone. Acetone should not be used on magnet tracks because it could break down the epoxy that holds the magnets in place.

**Table 4-1: Recommended Cleaning Solvents**

Item	Recommended Cleaner
Encoders, Magnets	Isopropyl Alcohol
Hardcoded Aluminum	Acetone

### 4.2.2. Cleaning Process

It is recommended that all air bearing surfaces are cleaned often to prevent damage to the stage or decreased performance. The entire stage should be blown with clean, dry, compressed air often to prevent dust from building up in the linear motors, encoders, and air bearing surfaces.

In order to clean the entire length of the air bearing surfaces and encoder scales, it will be necessary to move the stage.



**DANGER:** Strong rare-earth magnets are present in the linear motor magnet track. Loose metal objects (tools, watches, keys, etc.) may cause personal injury and/or damage to the equipment.



**WARNING:** Do not attempt to move the stage's carriage (or table top) until the air supply, detailed in [Section 2.6](#), has been installed. Moving the carriage without air supplied can cause permanent damage to the stage.



**WARNING:** Moving the stage table without air supplied can cause permanent damage to the stage. Refer to [Section 2.6](#) for more information about air requirements and installation.

Begin with the stage at one end of travel and remove power. Clean all accessible surfaces, being sure that the correct solvent is used on each surface (see [Table 4-1](#)). Once the cleaner has dried, move the stage by hand to the opposite end of travel. This should expose all previously covered surfaces. Repeat the cleaning process, and then restore power to the stage once all solvents have dried.



**DANGER:** To minimize the possibility of bodily injury or death, disconnect all electrical power prior to making any mechanical adjustments.

## Appendix A: Warranty and Field Service

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products that are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, where or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability or any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures. **Laser Products**

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review. **Return Procedure**

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warranted defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an airfreight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period. **Returned Product Warranty Determination**

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time, the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment. **Returned Product Non-warranty Determination**

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval. **Rush Service**

**On-site Warranty Repair** If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty-related, then the following policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material.

If service is rendered at times other than normal work periods, then special service rates apply. If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

**On-site Non-warranty Repair** If any Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies:

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

**Company Address**

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Pittsburgh, PA 15238  
USA

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Fax: 412-963-7459

## Appendix B: Revision History

Rev #	Date	Description
1.00.00	March 12, 2012	New Manual





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# Why Partner with Aerotech?

Aerotech offers its customers a number of important advantages as a single-source provider:

## Vertical Integration

Our expertise in motors, amps, controls and stages enables us to provide a complete optimized solution.

## Interconnectability

Aerotech systems are designed to work together. This allows you to spend time and resources on your process, not on system integration.

## System Checkout

Prior to shipment, all systems are fully assembled and checked out. All system parameters are factory-set based on your specifications.

## Documentation

All systems are fully documented. System interconnect-drawings, specification sheets and stage certification plots are included with every system.

## Support & Service

Because all system elements are designed and manufactured by Aerotech, we provide the highest level of technical knowledge available. Unlike companies that only manufacture part of the system, Aerotech manufactures all of the system components, minimizing service time.

## Single-Source Solution

Aerotech designs and manufactures precision stages, motors, drives and controllers giving you all of the components needed for a complete system.

## Application Experience

Since 1970, Aerotech has completed thousands of motion control projects, spanning an extensive range of applications.

## R&D

Our engineering teams are dedicated to product development and continuous improvement.

## Technology Leader

Aerotech engineers are continuously updating existing products and introducing new products. We are truly "Dedicated to the Science of Motion."

## Quality

Aerotech is an ISO 9001 certified supplier with a rigorous quality program.

## Worldwide Presence

Aerotech is committed to supporting customers worldwide. We operate full sales and service facilities in the United Kingdom, Germany, Japan, Taiwan and China. We also maintain a growing number of direct field sales and application engineering offices throughout North America, and work with representatives across the globe.



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Germany

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Taiwan

# Worldwide Training and Support



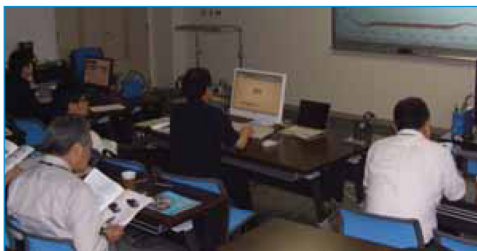
Aerotech Inc (U.S.A.)



Aerotech Ltd (United Kingdom)



Aerotech GmbH (Germany)



Aerotech KK (Japan)

Aerotech offers comprehensive worldwide training and customer service either at customer facilities or at one of our Aerotech training centers.

## Our Training Program Features:

- *Standard and customized courses*
- *Hands-on training with Aerotech positioning systems*
- *Interactive training with experienced instructors*
- *Comfortable, spacious facilities*

## Installation and Start up (Commissioning)

Startup and commissioning services minimize startup times, reduce cost and accelerate time-to-production. By combining our product knowledge with your process and application expertise, new systems and applications can be completed faster at a reduced overall cost.

## Engineering Support

Aerotech provides complete engineering support for our products, including on-site support and maintenance, and remote support via phone, fax, website and/or WebEx® software. As a manufacturer staffed by engineers, we understand the unacceptability of downtime.

## Training

Comprehensive training classes are designed to help our customers realize the full potential of our products. By demonstrating all of a product's features and how to use them, customers have been able to reduce startup time and quickly optimize their applications. Our classes have been developed, and continually upgraded, using feedback from our customers.

Since 1970, Aerotech has designed motion control and positioning systems and components with an unsurpassed track record of reliability. When you make the choice to purchase from Aerotech, we urge you to learn how to get the most from your new products. We provides both on-site (your facility) and/or in-house (our facility) training for our customers' convenience.